A Study of Sustainable Transportation Planning and Sustainability Indicators with Reference to Berkeley, California and Portland, Oregon

by

NgaYan Natalie C. Latham

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Signature of Author: _____
Department of Urban Studies and Planning
May 22, 1997

Certified by: _____
Kristina Hill
Assistant Professor of Urban Studies and Planning
Thesis Supervisor

Accepted by: _____
J. Mark Schuster
Associate Professor of Urban Studies and Planning
Chair, Committee for Master's in City Planning Program

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ABSTRACT

The legislation of ISTEA and CAAA in the early 1990s have significant impacts on the notion of sustainable transportation planning. Their provisions allow local communities to implement planning strategies towards the goals of sustainable development. Meanwhile, there has been increasing recognition of the need to establish instruments to evaluate the progress of the implementation of sustainable development strategies. As a result, sustainability indicators have been developed by public and private agencies and organizations as measurements for the level of sustainability.

This paper investigates the impacts of ISTEA and CAAA in relation to sustainable transportation planning. It also examines the categories and effectiveness of sustainability indicators for transportation identified by three different resources: the Interagency Working Group of Sustainability Indicators, Sustainable Seattle and the Hart Environmental Data. Additionally, the paper proposes supplementary indicators as well. Finally, the paper attempts to apply these indicators with reference to the Central City Plan of Portland, Oregon, and the Berkeley Downtown Plan of Berkeley, California, and to identify the role of indicators in the planning process.

Thesis Supervisor: Kristina Hill

Title: Assistant Professor of Urban Studies and Planning

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Chapter 1: Introduction

"The nation behaves well if it treats its natural resources as assets which it must turn over to the next generation increased, and not impaired, in value."

--Theodore Roosevelt

While there has been much discussion concerning how sustainability should be defined, the principles are fundamentally the same Sustainable development was defined by the Brundtland Commission, or the World Commission on Environment and Development, which addresses the capacity to meet the needs of the present without compromising the ability of future generations to meet their own needs. To do so the needs of society, the economy, and the environment must be balanced. At the global scale, sustainable development often deals with the equity issues between developed and developing countries. The extremes in wealth, natural resources, food supply and population are the sources of imbalances and manifestations of poor managements and dominance of strong countries over weaker ones. In order to remedy the situation it will require an equally vast effort to revolutionize the mindset of the entire human race. This, of course, would be impractical and impossible, but we can start from a smaller scale--the local scale.

Local sustainability has long been the effort and goal in western European countries. Britain, for example, has implemented a large variety of local planning strategies which aim at growth management for archieving long term sustainability. In the U. S., on the other hand, the process began in the early 1970s in some parts of the country. At that

time, the term sustainable development was not known and did not mean much to the public. However, in places like Portland, Oregon, communities had already initiated planning efforts with some of the principles of sustainability embedded in their comprehensive plans. It was not soon after the realization of the importance of planning responsibly, local communities had also discovered the level of difficulty to put the ideas to work in action. Something more concrete was definitely needed to help communities understand what they must do in order to make sustainability a realistic and workable idea.

Sustainable development involves many aspects of our lives, and there are many kinds of sustainability. To economists, sustainability primarily involves maintaining the economic well-being of a system or a particular society; to social scientists, sustainability concerns social equity issues in terms of income, class or races; to environmentalists, sustainability is concerned with environmental quality; for the planning profession, however, sustainable development implies a combination of all of the above. The urban system is very complex and it encompasses all of the issues mentioned above, and more. A sustainable urban system should include a healthy physical component including infrastructure and all the "visible" structures and a lively downtown area; an environment that can make residents "feel" livable; a healthy economic system where unemployment and income differences are not the norms; as well as a social culture where everyone has the same opportunities and is treated equally.

Many of these issues are beyond the scope of the discussion in this paper, but they indicate the level of complexity that will be involved when a community decides to plan sustainably. The emphasis of this paper is to introduce the concepts of sustainable transportation planning and sustainability indicators, the newest "buzzword" in the business. In doing so the impacts of recent legislation (ISTEA and CAAA) on encouraging communities to promote good transportation planning strategies will also be discussed. Moreover, two of the forerunner communities in sustainable development are examined, Their development plans prior to the implementation of sustainable development are selected as examples for discussion, in an effort to identify reasons for their success and any pre-conditions they may have led to efficient strategies. Finally, a conclusion will summarize the findings of this thesis and possible implications will be discussed.

Chapter 2: ISTEA and Sustainable Transportation Planning

2.1 Overview of ISTEA and CAAA

The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 and the Clean Air Act Amendments (CAAA) of 1990 are the benchmarks and major impetus for sustainable transportation planning. The passage of this legislation is the most revolutionary change in the concept of transportation in the U. S. since the Federal Interstate Highway Act in 1956. This is primarily due to three reasons:[1] 1. it designates states and localities as the fundamental determinants of how transportation priorities are set; 2. it provides unprecedented flexibility to transfer funds from one category to another to achieve transportation goals determined by state and local officials; and 3. it places a new emphasis on intermodalism (the use of interchangeable modes of transportation). The goals of ISTEA in facilitating active citizen participation and involvement in terms of advocacy groups and civic organizations, as well as encouraging the design and planning of neighborhoods with abundant open spaces for leisure activities and accessibility to job opportunities allow the public to reconsider the possibilities of limited use of automobiles. More importantly, ISTEA and CAAA together have identified the need for transportation planning regarding improvements on air quality, a change in federal funding to transportation planning projects, and also the significance of transportation alternatives. As a result, social, economic and environmental factors are expected to be considered major components of the planning process in addition to the traditional concerns of

[1] Martinez, Robert. "Perspective from the Office of Intermodalism." Transportation Research Board Special Report 240. 1993.

mobility and capacity of highways.[2] These two important pieces of legislation have planted the notion of sustainable transportation planning since the early 1990's, and this notion continues to evolve over time in terms of defining and refining the meaning and the methodology of reforming traditional planning. As noted in the Special Report on the Implementation of ISTEA Year Three, this program has created new opportunities to help federal, state and local transportation policies respond to a broader range of community and environmental goals. However, while there are many positive aspect of ISTEA, there are also negatives. As described by Liburdi,[3] The following are the strengths of the legislation:

- an emphasis on movement of people and goods and not only on modes.
- accessibility for promoting intermodalism is facilitated: economic strengths are linked to domestic and international transportation networks, which is also the key to national security.
- support for critical transportation needs, such as state and MPO (Metropolitan Planning Organizations) planning development, reconciliation of transportation projects is provided, and Clean Air Act goals, and safety and overall research and development are emphasized.
- flexibility in planning and funding for traditional highway and transit programs is increased, and the need for new programs is recognized.
- states and MPOs are given the authority in the decision-making process.
- multimodal and intermodal management plans are required in transportation improvement plans.

The weaknesses are the following:

- significant gaps exist in programs, policies, and funding related to economic competitiveness issues, including improvement in intermodal freight systems particularly in the availability of adequate data analysis.
- more change than can be realized under existing organizational structures is proposed. Agencies that are involved in the process need to have a good understanding of the kinds of interactions needed for successful implementation and program designs.

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[2] Franko, Margaret et. al. ISTEA Planner's Workbook. Prepared for Surface Transportation Policy Project. Washington, D. C. 1994.

[3] Liburdi, Lillian. "Keynote Address: The Promise of ISTEA." Transportation Research Board. Special Report 240. 1993.

- new priorities and institutional relationships that could produce more policy gridlock than create new cooperative results are established.

2.2 ISTEA, CAAA and Sustainable Transportation Planning

Although highway construction are still the conventional the solutions and principles of transportation planning in some parts of the country, activists are able to work with city and state officials to change the status quo with the provisions in ISTEA and CAAA. Examples include pushing for alternative transportation policies, calling for balance in private and public spending on infrastructure, redoubled efforts at managing growth while revitalizing urban neighborhoods.[4] Therefore, sustainable transportation planning is receiving increasing recognition as part of the ruling principles of ISTEA and CAAA. As mentioned in the paper by Howe and Brail,[5] the legislation has redefined familiar transportation concepts and requirements such as the 3-C process (Comprehensive, Continuing, and Cooperatively), Transportation Improvement Programs and the like. In February 1994, the Clinton Administration passed an Executive Order on Environmental Justice which required all federal agencies to develop strategies that would address environmental issues. Congress has provided specific funding programs to encourage projects that have not been traditionally programmed. Categories such as Surface Transportation Program (STP), Enhancements, and Congestion Mitigation and Air Quality (CMAQ) encourage projects that promote alternative modes of transportation,

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[4] Surface Transportation Policy Project, ISTEA Year Three: A Special Report on the Implementation of the Intermodal Surface Transportation Efficiency Act of 1991. Washington, D. C. 1994.

[5] Howe, Linda and Brail, Richard. ISTEA and ITPDS: A New Conceptual Model for Interactive Transportation Planning and Decision Support. Working Paper No. 76. Transportation Research Record. 1994.

help conserve and protect the natural and built environment, and make communities more livable.[6] In other words, ISTEA, together with CAAA, has provided a framework, as suggested by McLeod[7] that encompasses new emphases for changing traditional transportation planning decision steps:

- Multimodalism
- Flexible funding
- Joint Federal Transit Administration (FTA) and Federal Highway Administration (FHWA) processing
- Early consideration of environmental factors in planning
- Consideration of Clean Air Act Amendments and conformity
- Fiscal constraint
- More public involvement at early stages
- Focus on problem solving
- New capacity not an automatic first option

These elements in the framework are essential in developing sustainable transportation planning. I believe that multimodalism and intermodalism are the keys to responsible transportation planning strategies. Multimodal planning, as defined by Meyer,[8] focuses on system (mode) choices. Intermodal planning therefore emphasizes the most efficient way of moving from point to point through the system. An intermodal system should include both the points of connection and the links between them. The conventional approach to solving transportation problems and growth management has been auto-dependence--using a primary focus on highway construction and creation of relatively remote smaller suburban towns connected only to one another and to the

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[6] Surface Transportation Policy Project. ISTEA Year Four. Washington, D. C. 1995.
[7] McLeod, Douglas S. "Integrating Transportation and Environmental Planning: Extending Applicability of Corridor and Subarea Studies and Decisions on Design Concept and Scope." Transportation Research Record No. 1552. Transportation Research Board. National Academy Press. Washington D.C. 1996.
[8] Meyer, Michael, D. conference findings, ISTEA and Intermodal Planning: Concept Practice Vision. Irvine, California. December, 1992.

downtown area by vast lengths of highways. Multimodal and intermodal planning facilitates the possibilities of utilizing various ways of traveling other than automobiles. The elements listed above provide a fresh look at how future planning should evolve, as well as a change in the mindset as how we should see transportation as a whole.

However, as sustainability or sustainable development has become such a "buzzword" in academia and professional practice, many have argued in recent literature and research that not only a definition is needed, but also a mechanism to measure the level of "sustainability." Just how successful are those communities which have implemented plans for sustainable development? The answer will be significant in advancing our knowledge in this issue.

It is my position to argue that sustainable transportation planning could have some of the most fundamental impacts on our lives, now and in the future. The legislation of ISTEA and CAAA are evidence of this importance along with the attention from the federal government. As a result governments at all levels are realizing the significance of responsible planning. Local governments and other jurisdictions have begun creating or revising current comprehensive plans that can follow the direction of the Acts, as part of the initiative to gradually modify the traditional approaches of urban planning. Nevertheless, the concept of sustainable development with respect to transportation is relatively new to communities despite their past efforts in pursuing environmentally-friendly planning. Their attempts have made clear that there need to be measures for

sustainability. Therefore, sustainability indicators have emerged recently and are getting increasing attention from both academicians and professional practitioners. In particularly, Section 108 of the CAAA suggests sixteen transportation control measures that have direct implications for sustainability. Many indicators have indeed been derived from these measures listed below:

- improved public transit
- limitations and restrictions of certain roads or lanes to transit and high occupancy vehicles
- employer-based transportation management
- trip reduction ordinances
- traffic flow improvements to achieve emissions reductions
- park-and-ride/fringe parking
- programs to limit auto travel during peak periods (including congestion pricing)
- ridesharing programs
- pedestrian and bicycle facilities
- bicycle storage facilities
- programs to reduce extended vehicle idling
- programs to reduce extreme cold starts
- flexible work schedules
- programs to promote non-automobile travel to major activity centers such as shopping centers, special events, and other centers of vehicle activity
- programs for new construction and major reconstructions of paths, tracks, or areas solely for the use of pedestrian or other nonmotorized means of transpiration
- voluntary removal of pre-1980 vehicles ("cash for clunkers")

The following chapter will introduce the indicators themselves, as they have been developed, and discuss their effectiveness for measuring the level of sustainability of communities with respect to transportation planning.

Chapter 3: Sustainability Indicators--Transportation

3.1 Overview of Sustainability Indicators

Indicators are used to measure some sort of conditions in order to identify their state of being. While there are many definitions of sustainability indicators with slight different variations of meaning, I was most comfortable with the one established by Sustainable Seattle, a volunteer network and civic forum working to improve the region's long-term cultural, economic, environmental, and social health vitality. It states that:

> "indicators are bits of information that highlight what is happening in the large system. They are small windows that provide glimpse of the "big picture." They tell us which direction a critical aspect of our community, economy, or environment is going: forward or backward, increasing or decreasing, improving or deteriorating, or staying the same....By designing them carefully, watching them closely, and interpreting them wisely, we know the status of our flight and can make good decisions about where to go. Without indicators, we're just "flying by the seat of our pants."" (Sustainable Seattle, 1993)

This definition provides the meaning of sustainability indicators without the use of jargon or difficult terminology that only professionals in the field can understand. I found it important for such information in which raising public awareness is the primary purpose, can be successfully conveyed in a language that can be grasped by the general public. From this definition, sustainability indicators are instruments used to measure the level of sustainability. According to the Interagency Working Group on Sustainability Indicators Group (SDI Group), which reports to the Council on Environmental Quality in the Executive Branch of the Federal Government, these indicators are various statistical

values that collectively measure the capacity to meet present and future needs and provide information crucial to decisions of national policy and to communities.[9]

3.1.1 Categories of Sustainability Indicators

Recently, the concept of sustainability indicators has received more and more recognition. There are many sources of indicators for sustainability classified into three general categories: 1. local community indicators; 2. state indicators; 3. national indicators; and 4. global indicators.

First of all, examples for local community indicators are abundant, such as the Sustainable Cambridge Coalition formed in 1991 in Cambridge, Massachusetts, the Jacksonville Community Council, Inc., a volunteers organization in Jacksonville, Florida formed in 1985, Sustainable San Francisco, a collaboration of city agencies, businesses, environmental organizations, elected officials, and concerned individuals formed in 1993. Moreover, state indicator programs are established in states like Minnesota and Oregon. Furthermore, national indicator programs include the U. S. Council on Environmental Quality, and the Interagency Working Group on Sustainable Development Indicators (SDI Group), which will be discussed in detailed in latter section; the Government of Alberta, Canada initiated a program to monitor progress toward sustainability goals and to create a framework for government accountability by establishing categorical indicators in 1994; and in 1992, a program called the National Strategy for Ecologically Sustainable Development was launched by the Australian Department of Primary Industries and

[9] President's Council on Sustainable Development. *http://www.whitehouse.gov/pcsd*

Energy to develop indicators in the areas of agriculture, water resources and greenhouse effect, forestry, and tourism. Finally at the global level, the best known legislation is Agenda 21 drafted by the United Nations Conference on Environment and Development, the Earth Summit in 1992 aiming to develop indicators for sustainable development accessible worldwide to decisionmakers.

3.2 Indicators of Sustainability--the Details

While there are many different sets of indicators worth discussing in depth, there are three that are of particular interests to me. One of the U. S. examples is the creation of the President's Council on Sustainable Development (PCSD) established on June 29, 1993 by Executive Order 12852.[10] The members of the Council are of leaders from industry, government, environmental, labor and civil rights organizations. Its mission includes developing and recommending to the President a national sustainable development action strategy that will foster economic vitality; developing an annual Presidential Awards Program recognizing outstanding achievements in sustainable development; and raising public awareness of sustainable development issues and participation in opportunities for sustainable development. Based on this mission, the Council established eight task forces including one on "energy and transportation" and "sustainable communities." The energy and transportation task force focuses on developing long- and short-term policies to contribute to a more sustainable energy future. The sustainable communities task force emphasizing the investigation of obstacles and opportunities for sustainable development

[10]President's Council on Sustainable Development. *http://www.whitehouse.gov/pcsd*

at the community level. As a result, working groups have been created to help achieve the goals of the task forces. Two of the purposes of these groups are to create indicators of the progress of the U. S. in moving toward sustainable development, and to review the policies and programs of Federal agencies to identify practices that are consistent with the Council's definition of sustainability. One should note that the latter purpose coincides with the goals in the legislation of ISTEA in 1991.

As part of PCSD, the Interagency Working Group on Sustainable Development Indicators (SDI Group) has therefore proposed a small group of sustainability indicators based on the society, economy, and the environment. However, of the many categories of indicators being collected in the indicator inventory maintained by the Group, which the President's Council on Sustainable Development has contributed significantly, only one category and within it a few indicators directly address the transportation sector. This category is traffic congestion, and is defined as insufficient transportation infrastructure to handle traffic volume. The indicators are: 1. commuting time (travel time for work trips); 2. public transportation use (use of public and alternative transportation systems); and 3. transportation fuel consumption (transportation fuel consumption per capita).

Another source of indicators originated with the volunteer group "Sustainable Seattle." This group started the process of establishing indicators since 1991, and the first set was born in 1993 published in "Indicators of Sustainable Community 1993." Two years later in 1995, the group had refined its work to further publish the "Indicators of

Sustainable Community 1995." As noted in the 1995 Report, the purpose is to "inspire [residents] to act, as a community, in the interests of those who come after [them]. For the foreseeable future, [residents] will continue to face many difficult decisions: how do [they] protect the environment, meet everyone's basic needs, keep the economy dynamic, create justice and well-being? How do [they] make hard trade-offs and balanced judgments that take everyone's interests into account, including those of our generations?" Therefore, these "Indicators of Sustainable Community" are "designed to help us direct our course toward the future we want. They provide important information that should serve as a foundation for action--and for a renewal of our sense of hope."[11] According to their 1995 Report, they have also established criteria for good indicators. They are listed as the following:

> Indicators:
> - are leading tests of sustainability. They reflect something basic and fundamental to the long term economic, social, or environmental health of a community over generations;
> - must be accepted by the community. They are understood to be a valid sign of sustainability (or symptom of distress);
> - need to be attractive to local media. The press publicizes them and uses them to monitor and analyze community trends;
> - are also statistically measurable. Data exists that is relevant to [one particular] geographic area, and preferably comparable to other cities, counties or communities. If data are not readily available, a practical method of data collection or measurement exists or can be created;
> - need to be logically or scientifically defensible. Good rationales exist for using the specific indicator and for drawing general conclusions from it.

The indicators in the Report are therefore divided into five different categories: environment, population and resources, economy, youth and education, and health and

[11] Sustainable Seattle. *http://www.scn.org/sustainable/indicators.html*

community. While sustainable transportation planning is not the primary theme of these indicators and the Report, there is one indicator which measures vehicle miles traveled and fuel consumption within the category of population and resources. It states that the more we drive, the further we are away from sustainability. It is because increased miles traveled reflect increased use of resources; decreased ability to work, live and participate in the neighborhood or local community; and an increased amount of time spent on what is generally not a productive or enjoyable task of commuting.

Vehicle miles traveled and fuel consumption is an indicator for sustainable transportation practices because Sustainable Seattle believes that these two factors are linked to excessive use of non-renewable resources, pollution, loss of open space and wildlife habitat, decreased social health as a result of stress and pollution, and a declining sense of community. They also believe that many of these so-called externalities can be relieved by switching transportation modes to more use of mass transit, walking and bicycling, as well as increasing efficiency, and at the same time taking into account land use and other social factors, such as increase in the availability of affordable housing near work in order to reduce use of vehicle and urban sprawl.

The final set of indicators discussed in this paper is proposed by Ms. Maureen Hart in her research and book "Guide to Sustainable Indicators (1995)." As an environmental data analyst over 17 years, she has been involved with information management and various branches of the U. S. Environmental Protection Agency. The Interagency Working

Group on Sustainable Development Indicators has also drawn pieces from her work to include in their inventory of indicators. Hart Environmental Data, a website she developed for the purpose of conveying the information to, motivating and educating the public, has identified different categories for the indicators, in addition to the popular ones such as economy, society, environment and government.[12] These categories include education, public safety, health, recreation, resource use, quality of life, transportation and population. It also suggests a checklist composed of 10 questions with points assigned to each correct answer for evaluating indicators. Below is a glimpse of the checklist:

[12] Hart, Maureen. Hart Environmental Data.
http://www.subjectmatters.com/indicators.htmlSrc/indicators.html

Indicator Characteristics	Maximum Points
Is the indicator relevant to the community's definition of sustainability? Sustainability in an urban or suburban area can be quite different from sustainability in rural town. How well does the direction the indicator is pointing match the community's vision of sustainability?	2
Is the indicator understandable to the community at large? If it is only understood by experts, it will only be used by experts.	2
Is the indicator developed, accepted, and used by the community? How much do people really think about the indicator?	3
Does the indicator provide a long term view of the community? Is there information about where the community has been as well as a goal set for where the community should be in the future?	3
Does the indicator link the different areas of the community? The areas to link are: culture/social, economy, education, environment, health, housing, quality of life, politics, population, public safety, recreation, resource consumption/use, and transportation.	6
Is the indicator based on information that is reliable?	1
Is the indicator based on information that is accessible?	1
Is the indicator based on information that is timely?	1
Is the indicator based on information that is accurate?	1

Source: Hart Environmental Data, 1996.

Transportation is one of the categories of indicators, and Hart suggests there are five more subcategories within it. They are 1. the availability and use of bike paths for commuting and recreation; 2. availability and use of different ways to get to work; 3. the availability and use of transportation options of the disabled; 4. availability and use of public transportation; and 5. the types of vehicles used and the energy used to fuel them. Additionally, the Hart Environmental Data lists examples of better indicators and poor indicators of these subcategories, as follows:

	Better indicators
Measure of a solution	Percent of streets with adequate pedestrian and bicycle facilities
Measure of appropriate level and type of consumption	Ratio of fuel efficient to fuel inefficient vehicles and renewably fueled vehicles to nonrenewably fueled vehicles
Measure of solution to problem	Percent of commuters using public transportation
Measure of solution to problem	Number of commuters living within 30 minutes of work
	Poor Indicators
Incomplete measure of the problem	Motor vehicle registration
Measure of short term aspect of transportation	Percent of highways built to handle steady 55 mph traffic flow
Not relevant to community sustainability	Number of people living within 50 miles of daily air passenger service

Source: The Hart Environmental Data, 1996.

3.3 The Pros and Cons of the Indicators (Transportation)

It could be difficult to compare the "goodness," or effectiveness of these indicators because each set is researched and refined to suit the interests and philosophies of the organizations that establish them. In most cases, there are certain pre-established goals or objectives that these indicators are used to achieve, for example, or they are applicable only in certain geographic areas. In other words, these indicators are often times case-specific, designed to meet particular purposes of a project or case study, or to solve certain problems that a particular jurisdiction needs to deal with at a specific time. All but one of the indicators examined here, however, are designed for a more "generic" use. This is important because others who are interested in the actual measures of sustainable development can learn, evaluate, or even modify these indicators to suit their needs. The list of the indicators provided by the SDI Group of the President's Council on Sustainable Development and those provided by the Hart Environmental Data are in this case because they are not developed for any specific locale or client. Indicators used by Sustainable Seattle, on the other hand, are a little more site-specific; but one cannot ignore these indicators' "adaptability" or "flexibility" for applications in other cases with some modifications as their criteria of indicators are versatile and can be changed to suit any communities.

Though transportation is not the only issue that sustainable indicators attempt to address, the problem they are facing is very similar. The purpose of the Energy and Transportation Task Force of PCSD, which has partial contribution in identifying and

drafting the indicators, is to develop both short- and long-term policy recommendations and complementary implementation strategies in transportation development.[13] Its goals for sustainable development are threefold:

- to pursue economic, environmental, and social policies that encourage global competitiveness and a long term economic growth rate of at least 2.5 percent per year, realizing environmental improvements while providing opportunities and income gains distributed broadly throughout society and that contribute to reducing poverty and inequity;
- to improve the economic and environmental performance of the U. S. energy supply and use by ensuring that all Americans have access to affordable energy services and increasing the competitiveness of American business;
- to improve the sustainable performance of the U. S. transportation system. (PSDC, 1995)

The Sustainable Seattle Indicators Report, on the other hand, is drafted based on the premise that the "Seattle area is not moving toward the goal of long-term sustainability. Instead, it is moving in the wrong direction....[Their] goal in presenting these indicators is to alert the people of Seattle to the significant challenges [they] face, and to ask them to get involved in finding solutions to [their] problems. [They] hope to inspire a renewed sense of citizenship and participation."[14] Because of Seattle residents' concerns for the traffic conditions as a result of development and growth of the City, the indicator they have chosen greatly emphasizes on the vehicle miles traveled due to urban sprawl in the Seattle area. Decentralized and fragmented land uses, instead of mixed use, are to blame for the increasing commuting time and fuel consumption. Their indicator is thus design to address this particular problem which they argue that Seattle residents are facing.

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[13] President's Council on Sustainable Development. *http://www.whitehouse.gov/pcsd.html*

[14] Sustainable Seattle, The Sustainable Seattle Indicators Report Seattle. 1993.

Similarly, Maureen Hart of the Hart Environmental Data believes that "in a sustainable community, transportation will be less dependent on single occupancy vehicles that use nonrenewable fuels and more dependent on multi-occupant, renewably fueled vehicles. The need for transportation will be reduced in many cases because cities and towns will be designed so that walking is easy and convenient.[15]" Thus, the indicators to measure within this category of transportation are intended to address the issue of dependency on automobiles and the amount of pollution and poor air quality created as a result of that dependency. They also emphasize the significance of commuting by walking. Overall, the indicators proposed by Hart are intended for application in any communities interested in sustainable development.

The table below summarizes the sustainability indictors for transportation from the three sources that are being examined in this paper.

Table 1. Matrix of Transportation Indicators for Sustainability

Sources	Category	Indicators	Definition
SDI Group (1996)	Traffic Congestion	1. Commuting Time	Travel time for work trips.
		2. Public Transportation Use	Use of public and alternative transportation system.
		3. Transportation fuel consumption	Transportation fuel consumption per capita.
Sustainable Seattle (1993)	Population and resources	1. Vehicles miles traveled and fuel consumption	Miles traveled estimated from data provided by Department of Transportation, Washington.

[15] Hart, Maureen. Hart Environmental Data, *http://www.subjectmatters.com/indicators.html*

			Annual fuel consumption estimated based on revenues from motor fuel taxes.
Hart Environmental Data (1996)	Transportation	1. Bicycle	Availability and use of bicycling paths both for commuting and recreation.
		2. Commute	Availability and use of different ways to get to work.
		3. Disabilities	Availability and use of transportation options for the disabled.
		4. Public transportation	Availability and use of public transportation.
		5. Vehicle	Types of vehicles used and the energy used to fuel them.

3.3.1 Analysis of Indicators

It is quite apparent that there is a common thread among the indicators from these three sources. Two out of three use commute, public transportation, and fuel consumption of some sort as indicators. First of all, commuting time can indicate the distance residents need to travel to get from one place to another. While approximately 10 to 12 percent of total trips during the day are made within the morning and afternoon rush hours, work trips have become the primary consideration for this particular indicator. Because commuting time means the actual amount of time spent on traveling between places, it is again used by many people to indicate the degree of congestion particularly during rush hours. From this point it will usually lead to the number of cars being used on the road at

that time and therefore its connection with the level of service of roadways becomes obvious.

As commuting distance for work trips has increased over the years since the interstates were constructed, many authors and researchers have linked it to the diversification of urban development, or urban sprawl. People have moved to suburban areas to live away from their work place which is usually still in the downtown area.[16] This dependency on automobiles has become a problem that is difficult to solve. Though commuting time may be a good indicator to measure distance traveled and the severity of congestion, some caution needs to be used. The total time spent on travel may depend on many factors other than distance traveled and congestion. The design and layout of the network is one of the factors. Unnecessary turns and winding roads will certainly add to travel time. The configuration and number of points of connection, or connectivity within the network is another factor. In some places it will take hours to get from one side of the town to the other. Some of the less important factors are road conditions (how well the roads are maintained), the signal system, and the design of roadways (sidewalk present or not, etc.).

Public transportation is another indicator that goes hand in hand with commuting time, more or less as a solution to the problems caused by it. It represents use of an

[16] Though there has been a reverse in this trend in some parts of the country mainly in larger cities, statistically, the percentage of people moving to suburban centers still outweighs the percentage of people moving back to the downtown area for the country as a whole.

alternative to private transportation. The logic behind its connection to sustainability is simple. Studies have indicated that it is better to put many people on board one single vehicle than many single-occupancy automobiles. It will take up less space on the road, traffic can flow a little smoother, air quality will be a little better because less emissions will be produced, thus alleviating the congestion problem. I question, however, whether public transportation can really be the antidote to increases in commuting time. If it is proposed as an indicator of sustainability in the category of transportation, then it should logically follow that the lower the commuting time is, the more sustainable the transportation system is in that area. This will then pose a question. If personal time spent on work trips travel is the factor being accounted for by the indicator of commuting time, then in some cases public transportation may actually take longer, depending on the geographic area and the development of the public transportation system. Infrequent buses that constantly run behind schedule will not be a good alternative for reducing commuting time, although they may reduce congestion and emissions. Therefore, one must be cautious and well-informed about the local transportation conditions, both public and private before, selecting indicators.

Fuel consumption, on the other hand, is considered an indicator based on the assumption that the higher the consumption, the greater the use of automobiles, and therefore the air quality is more degraded by emissions. Because the data and the method used to collect the data for the estimation of fuel consumption vary from place to place, one must be careful to ensure that the data truly represent the concept defined by the

planners. For example, transportation fuel consumption in the SDI group is expressed as the consumption per capita, whereas Sustainable Seattle, uses the annual fuel consumption estimated by revenues from motor fuel taxes. These two different numbers can mean very different things and therefore result in very different conclusions. Per capita measures the fuel used *on the average* by each individual residing in the jurisdiction. This can be influenced by extremes, as in many cases of measurements when the statistical mean is used. For instance, if a community has a high concentration of elderly persons who do not tend to drive too much and a downtown area where most of its workers commute from outside the area, though congestion in downtown may be quite high and air quality may be low, the fuel consumption per capita for that particular area will still be small. When annual fuel consumption is based on revenues from motor fuel taxes, caution must be used for two reasons. This can be used as an indicator when the locality is specific, and the total revenue is estimated for that one place. Different jurisdictions have different tax rates and therefore generalized estimates will confound geographical patterns. Another reason for caution is that if the data are being studied as a trend from the past and projected into the future, then the historical variation of the tax rates within the jurisdiction will need to be considered. If fuel taxes have been raised during the studied period then the outcome maybe misleading.

I believe that if caution is used when applying these indicators, they can be quite helpful in assessing the conditions of local transportation systems in terms of sustainability. Since these indicators alone may not be adequate in addressing the issue, I also propose

the indicators below as an effort to identify indicators that can help make the list more complete.

Table 2. Proposed Indicators

Indicators	Definition
Carpool	Number of work trips made by carpooling
Efficiency of public transportation	Measured by factors including ridership, operating expenses, service area, scheduling and overall customer satisfaction
Fuel consumption	Measured by gallons used in private automobiles
Construction of highway	Miles of new highway built every year.
Pedestrian and bicycle facilities	The availability of pedestrian walkways and crosswalks; and facilities and paths for bicycles.

Carpooling will be a very important source of information for measuring the level of transportation sustainability. There are primarily three reasons. First of all, since one of the criteria for good indicators is that they can be statistically measured, many cities have adopted the "high occupancy vehicle lanes" strategy to alleviate traffic congestion during rush hour. The data on carpooling can then be collected daily for accuracy. Carpooling can also achieve the objective of reducing personal commuting time actually spent on the road as a result of a good HOV policy, and at the same time minimizing the time used for connecting to public transit or waiting for infrequent buses. Carpooling is also a good indicator for places where public transportation may not be a good option for transporting people to work. This is particularly true for smaller or mid-sized cities. Mid-sized cities specifically have a higher degree of congestion for two reasons: the highway systems are

often not constructed to deal with the level of trip rates, unlike larger cities where the road networks are quite well-established to handle their level of traffic; most of the population in mid-sized cities commute to work from suburbs, thus creating a higher dependency on private automobiles; and public transportation systems are less efficient due to a lower population density per square mile. As a result, public transportation systems in smaller or mid-sized cities (for example, Charlotte, North Carolina) often do not work as well. Carpooling then becomes a more viable option than public transit for these cities. The indicator of carpooling is also than the indicator of public transportation systems because such indicator is only applicable to places where such systems have a more primary role in transporting people to work. The rate of carpooling is simpler to measure than the efficiency of a public transportation system because of the type of data involved in the analysis, and may be prepared to larger cities as well, thus crossing the range of city sizes.

This is not to say measuring the efficiency of public transportation is not important. In fact, I believe that it has been overlooked by some of the indicators found in the literature. The authors of these indicators proposed to examine public transportation only by analyzing the usage and availability of it. In a truly sustainable transportation system, this will not be sufficient. Sustainability requires efficiency, and by only analyzing the usage and availability, and not the efficiency of it (taking into account ridership, operating expenses, the extent of service areas, scheduling and the overall customer satisfaction), an indicator for public transportation usage and availability will not be very revealing.

On the other hand, the indicator of fuel consumption which I propose would be measured differently than the indictors discussed in this paper. Fuel consumption can be a good indicator only if it is measured by the actual amount used for private automobiles. Some may argue that this information will be difficult to collect, but annual surveys to sample households will be able to estimate the amount of fuel in gallons used for driving. It should always be emphasized that none of these indicators can be used alone to identify the level of transportation sustainability. Therefore, fuel consumption should be used with caution and along with other indicators in order to avoid misleading results.

Miles of new highway constructed every year is also a good indicator. A sustainable city should be compact and mixed use development where shopping and work places are within the distance at which driving is not necessarily required. If highways are built for connecting suburban development to downtown areas because most jobs are there, then the goal of sustainable development is yet too far to reach. As a student of the most basic urban sprawl theory can tell, it encourages driving (as shown by increases in trip rates), which leads to poor environmental quality. It also makes public transportation less possible because population is not concentrated in one place to support it. Urban sprawl is indeed the ultimate concern and is the process which makes sustainable development so important.

On the other hand, the availability of pedestrian and bicycle facilities is an indicator because walking and biking have been efficient alternatives to work in many European

countries for many years. For example in Denmark, bicycles are public property readily available on streets for use by depositing a small fee. The fee will be returned after dropping off the bicycles at the destinations of the users. Mixed use development allows residents to live in reasonable proximity to work and shop by walking and bicycling. A pedestrian- and bicycle-friendly environment can help to reduce the use of automobiles and energy consumption, and to improve air quality leading to more sustainable and livable communities.

Chapter 4: Using Indicators: The Central City Plan of Portland, Oregon and the Berkeley Downtown Plan of Berkeley, California

One of the purposes of this chapter is my attempt to apply the indicators discussed in this paper in order to evaluate the transportation component in the development plans from Portland, Oregon and Berkeley, California. Portland, Oregon has a long history and reputation as the pioneer of implementing sustainable development strategies and the innovation of tools for archieving that goal. Berkeley, California, on the other hand, has begun to experience growth pressure since the mid-1980's. The two plans are selected for discussion in this paper among the others because they symbolize and represent the vision of the cities and their attempts of growth management specifically for resolving the pressure of the transportation system in the downtown area.

4.1 The Central City Plan of Portland, Oregon

The Central City Plan was initiated in 1984 by the City Council. It was then approved and adopted in 1988 as a part of Portland's Comprehensive Plan. The mission of the Plan is "a vision for the future, which establishes the Central City as the center of commerce and cultural activities in the community, recognizes the unique environmental setting and historic precedence of the area, incorporates the residential and business characteristics of individual districts within the area, preserves the integrity of adjacent neighborhoods, and improves the livability of the area for all citizens." As a response to the mission, the Plan was drafted to meet the following objectives and purposes of the community in the next twenty years:

- clarify the functional role of the Central City and its relationship to the larger community
- identify feasible public actions to assist and attract private investment in the Central City
- identify additional public amenities that contribute to the urban and natural environment, and to a livability for citizens within that environment
- assure a human scale, an inviting environment, and attractions for residents as well as visitors in an area that continues as the center of commerce and cultural activities in the community
- support and promote existing goals and policies of the City of Portland

The Plan covers an area of about 2,750 acres of land divided by the Willamette River. The river occupies about 13% of the area, creating four miles of shoreline on each bank within the Central City. According to the history described by the Plan, the Central City was combined by Portland, East Portland, and Albina in the 19th century (Figure 1). Over the years, each began to develop as components of a larger economy. The former community of East Portland and the eastern area of Albina became Portland's first industrial districts. The west side of the Willamette river became the center of retail and office activities and later the Downtown area. The emergence of the automobile-based transportation system and changes in industrial technology together with the natural growth of the City, had begun to acknowledge the need for a new evaluation of the relationships between the districts in the Central City. As a result, the Plan indicated that Portland's development of transportation, water and sewer facilities, and open space areas complimented and encouraged investment in new development as well as business expansion. The forces which had been exerting pressure for change in the districts of the Central City would need to be realistically reconciled with the types of growth and change desired by the community. The Central City Plan presented such a reconciliation. It

balanced the needs for various public and private sectors of the city's economy, the supply of land, and the community's ability to provide services for new development.[17]

Therefore, the goal of the Central City Plan and a Comprehensive Plan policy, is to "encourage continued investment within Portland's Central City while enhancing its attractiveness for work, recreation and living. Through the implementation of the Central City Plan, coordinate development, provide aid and protection to Portland's citizens, and enhance the Central City's special natural, cultural, and aesthetic features." (Central City Plan, 1988) The Plan is divided into 21 functional policies as the core. While it is impractical to examine every policy in detail, it is important to direct our attention to the transportation policy in particular.

4.1.1 Transportation

The goal of the transportation policy is to "improve the Central City's accessibility to the rest of the region and its ability to accommodate growth, by extending the light rail system and by maintaining and improving other forms of transit and the street and highway system, while preserving and enhancing the city's livability." (Central City Plan, 1988) Based on the background and development trends of the central city area, the transportation policy identifies the following 11 goals to help achieve the above objective.

- developing the Central City as the region's transportation hub through construction of a regional light rail transit system.

[17] Bureau of Planning. City of Portland, Oregon. The Central City Plan of Portland, Oregon. Portland: 1988.

- working with Tri-Met (the Tri-County Metropolitan area which includes part of Washington State) and other metropolitan area jurisdictions to locate and obtain funding to complete the regional light rail transit system.
- supporting transportation facility improvements that improve the flow of traffic to, within and through the Central City.
- recognizing that parking is an important element in the transportation system which supports growth and ensure that each district has adequate parking while improving air quality and traffic flow.
- encouraging the use of bicycles and other alternative modes of transportation for general access into and within the Central City by improving the pleasure and safety of the transportation system.
- separating bikeways and pedestrianways wherever it is both practical and possible, especially in parks and open spaces.
- protecting residential neighborhoods from auto and through through-traffic
- develop new systems and better utilize the existing transportation system to promote tourism by connecting the City's hotel, retailing, recreational, cultural and entertainment attractions.
- improving the movement of goods to, from and within the Central City.
- developing an integrated transportation system where each mode, and the system as a whole, is both efficient and practical.
- preserving access for all transportation modes on right-of-way that lead directly to and from bridges.

The following actions are designed to meet the above goals:

- engineering and constructing the west-side light rail line.
- planning and constructing the remaining portions of the regional light rail system.
- planning and constructing an inner city transit loop.
- allowing the use of some local service streets in industrial areas for angled parking for employees, and for loading.
- developing informational guides, directional signs, and maps explaining the location and operation of auto and bike parking within the Central City.
- designing and installing traffic control devices to keep through auto and truck traffic from infiltrating into residential neighborhoods.
- clearly designating and signing truck routes to and within industrial areas.
- creating a safe, clear and pleasant system of walkways and bikeways.
- developing a system of short-term parking facilities in the Central City.
- developing an improved parking data system.
- developing a parking strategy for each Central City district, and for specific sectors within the Downtown, review and make recommendations on the parking needs of each districts, update this information regularly.

- encouraging the development of Bike Central bicycle commuter facility near employment centers.
- encouraging reduced parking rates on weekends and at night.
- encouraging new parking facilities to stay open in the evenings/weekends.

4.1.2 Evaluation

Although sustainable development was not the primary goal of the Portland's Central City Plan, its overall objective was clearly leading towards this goal. The Portland area has always been identified with the light rail system, which has been praised as one of the most comprehensive and effective system in the country for helping to mitigate traffic conditions. The recommendations in the Central City Plan first aimed at improvements on the light rail system making it more complete and regional suitable for a larger service area incorporating the needs of residents to utilize it from the outer edge of the City. The Central City Plan then proposed the construction of an Inner City Transit loop which could improve circulation and connection within the City to alleviate congestion in the downtown area. By the same token, the Central City Plan suggested to better utilize the existing transportation system in order to work hand-in-hand with the proposed additional construction of the light rail transit. Thus, the sustainability indicator of efficiency in public transportation system can be used to measure the Plan's emphasis on the significance of an efficient and practical integration strategy of public and private transportation with the consideration of combining other strategies such as park-and-ride and ridesharing. Moreover, the Central City Plan also devoted attention to the overall networking of the existing roadway. Its support for transportation facility improvements that would improve

the flow of traffic to, within and through the Central City; design and installation of traffic control devices to keep through auto and truck traffic from residential areas, clear designation and sign truck routes to and within industrial area, were aimed to help reduce the travel time for work trips and for transporting goods and services.

On the other hand, the use of bikeways and pedestrianways are proposed not only as an alternative to vehicular transportation modes but also as amenities in parks and open spaces, and as facilities for commuters near employment centers. The indicator of the availability of pedestrian and bicycle facilities can thus be used here to evaluate this recommendation for sustainability. Portland has long enjoyed the reputation of a sustainable city. Its efforts to achieve this goal have been demonstrated by the transportation other recommendations Central City Plan. The City's devotion to responsible planning practice is evident throughout this Plan.

4.1.3 Policy Implications

Indicators are instruments to evaluate policies, strategies and recommendations leading towards the goals of sustainable development. In the case of the Central City Plan of Portland, the recommendations in its transportation policy have clearly demonstrated their efforts in making progress towards the goals of sustainability after the evaluation using the indicators. It should be noted that the Central City Plan was adopted in 1988, pre-dating the legislations of ISTEA and CAAA. The recommendations in the Plan

coincided with the policies in the legislations regarding transportation planning, indicating that Portland is truly a pioneer in moving towards sustainable development.

I also need to emphasize the fact that sustainability indicators are more useful when they are actually used to evaluate planning strategies once they have been implemented. Indicators should therefore be incorporated in the planning process as benchmarks or checkpoints when recommendations are being made. It should be kept in mind that a good planning process involves constant updates and revisions as a plan is being implemented. Indicators should be used in the process of updating and revising the plans. In the case of the Central City Plan, if the indicators show that the recommendations and current conditions are not making progress moving towards sustainability, then changes in the Plan may be necessary. An open-minded municipal regulatory and legislative body in Portland will then be essential to the success of the planning process. Its recognition of the need for improvements in the Plan in order to move towards sustainability and the willingness to make and implement such changes are crucial when using indicators. The citizens and officials in the City of Portland have been very aggressive and actively participating in the planning process. Therefore, the use of sustainability indicators should be incorporated effectively as part of the feedback procedure in this planning process.

4.2 Berkeley Downtown Plan, Berkeley, California

The planning process of the Berkeley Downtown Plan began in 1987. After rigorous revisions and improvements, it was adopted in 1990 by the Planning Commission and the City Council. The purpose of the Plan was to "establish the Downtown as a compact, economically vital historic city center with a defined core area and transition zones buffering residential neighborhoods. The Plan respects the City's values for protecting its historic character, cultural diversity, social equity, and human scale of development, while improving economic vitality and the physical environment." (Berkeley Downtown Plan, 1990)

The City of Berkeley encompasses an area of 79 acres (Figure 2). It is an area with approximately 3.8 million square feet of floor space, which includes office spaces, institutional including government space, retail use, auto related uses, other services, and residential. The Plan therefore identified the following goals to meet the objectives and policies:[18]

- expressing and enhancing Berkeley's unique social and cultural character in the Downtown:
    - Historic preservation: to encourage adaptive reuse if existing buildings, to encourage economic revitalization while preserving historic character; special design guidelines to ensure new construction to enhance the character.
    - Cultural activities: to call for street fairs, art festivals, and additional space for cultural and entertainment activities.
    - University of California presence: to propose an university historical museum and university events.
    - Housing: to establish housing to meet demand and create a 24-hour environment; the use of zoning regulation as incentives for housing; and

[18]City of Berkeley Planning Department. Berkeley Downtown Plan, Berkeley, California. Brekeley: 1990

financial help from the City to encourage residential development and preservation.

- creating an appealing and safe Downtown environment, with a comfortable pedestrian orientation:
    - Street improvements: to make improvements on street furniture, trees, and clean-up efforts; and changes in traffic control devices to improve pedestrian safety.
    - Open space: to make long-range capital improvements, improving the Civic Center and park area as a focal point of cultural life, and improving the station plaza area.
    - Safety: public and private sectors to support programs to increase police protection and improve safety measures for fire, toxic, pollution, and seismic hazards.
    - Energy: public and private sectors' cooperation to establish development guidelines and programs to protect solar access, conserve space heating energy and other uses of energy, and recycle resources.
    - Growth management: mechanism to mitigate traffic impacts to maintain an acceptable level of transportation service in the Downtown; to require developers to offset the public costs of development through mitigation fees.
    - Zoning regulations: to encourage desirable uses in the Downtown area with respect to densities and historic character.
- diversifying, revitalizing, and promoting the Downtown economy:
    - Main street program: to encourage business to establish a main street program for the promotion of Downtown as a central business district and to serve residents; to enable the preservation of historic character in the Downtown area through adaptive reuse of existing structures.
    - Employment: job training, referral services and job guarantee for Berkeley residents.
    - Transportation system management: to discourage the use of single occupant vehicles for commuting through ridesharing, transit and bicycle use, and work scheduling.
    - Parking: to establish parking management plan to make efficient use of existing and future parking facilities.

4.2.1 Transportation

The Berkeley Downtown Plan had seven different sections to reflect the above objectives and goals identified by various public meetings over the two-year period since it

was originally initiated. Transportation was one of the major focuses of the Plan in which it emphasized a pedestrian-oriented downtown, the need to improve the retail shopping sector and the maintenance of infrastructure at an acceptable service level. As a result, the Berkeley Downtown Plan recommended to decrease the use of single occupant vehicles, improvements on alternative modes of transportation and circulation system which could accommodate existing and projected land use to respond to the increasingly congested downtown area. The following table indicates the work mode split and average length of work trips.

Table 2. Work mode split and trip length

Destination	Drive alone	Shared Ride	Transit	Walk Bike	Trip length (1-way)	Source
Central Business District	35% 40 43	19% 12 7	31% 37 40	15% 11 10	76% < 10 miles	a b c
Univ. of California	49% 47 60	15% 16 10	11% 13 12	25% 24 18	avg. 8.6 mi.; 67% < 10 mi.	d e f
Central Berkeley (includes dtn, U. C., LBL, N.side/ S. Campus	48%	18%	19%	15%	avg. 5.3 mi.; 67% < 4 mi.	a

Sources: Berkeley Downtown Plan, 1990.

a. MTC (1997).

b. Workplace Survey (1981); does not include employees of U.C. Systemwide or of business with fewer than 25 employees.

c. Workplace Survey (1983); does not include employees of U. C. Sample represents downtown employers with a total of 3525 employees. Multiple responses were obtained, so results were normalized to add to 100%.

d. MTC (1977); includes students who work half time or more on campus.

e. U. C. Faculty/Staff Survey (1980); omits students and occasional employees.

f. U. C. Faculty/Staff Survey (1985); omits students and occasional employees.

Moreover, in terms of parking needs for the downtown area, surveys on public parking occupancy and an inventory of all off-street and on-street parking facilities in the area were conducted. These surveys indicated there was a shortage of parking for both short term users, shoppers and business-oriented trips, and for long term parkers and employees. At the same time, although the level of transit service was high, there were some problem areas making transit inconvenient for many downtown employees and visitors. The Plan stated that many residents lived too far from a transit stop or BART Station. The trip for some residents would take too long because of the need to transfer, frequent stops, and infrequent service. On the other hand, inadequate pedestrian facilities was also a problem. The timing of some pedestrian signals were too short to allow for crossing intersections; too many newspaper racks and ATM machines where pedestrians were in conflict with traffic, trying to cross the road, and do the transactions. The Berkeley Downtown Plan identified the downtown bicycle system as discontinuous and lacking adequate signing. Insufficient signing and bike storage posed dangerous for both motorists and cyclists.

Therefore, the Plan recommended six objectives and specific policies as summarized below to resolve the problems described above:

1. Encouraging the use of transit as the primary mode of travel:
    - increase transit access to and from the Downtown in response to commute patterns.
    - develop shuttle transit service to supplement AC service to the Downtown from residential neighborhoods and satellite and peripheral parking facilities.

- minimize the conflict between transit vehicles and other vehicles requiring the use of Downtown streets for both safety and improvement of bus operating speeds.
- provide safe, conveniently spaced and weather protected bus stops near major public and private facilities which attract potential transit riders.

2. Insuring adequate vehicular access to, from and within the downtown:
   - minimize conflicts among auto, transit, bicycle and pedestrian uses for a safe circulation system in the Downtown.
   - channel vehicular traffic onto primary auto oriented streets.
   - in the Downtown core minimize conflict between autos entering and exiting onto the street network.

3. Creating adequate parking facilities to support land use policies for the Downtown
   - increase the availability of short term parking spaces on the periphery of the core Downtown area.
   - discourage the use of existing public and private parking facilities for long term parkers in the high demand area of the Downtown core.
   - provide new long term parking facilities at remote locations adjacent to transit lines or shuttle service.

4. Decreasing single occupant vehicle trips to and from the Downtown to create a viable and livable environment:
   - actively promote the use of alternative means of transportation to the single occupant vehicle.
   - establish a Transportation System Management Plan for the Downtown which requires participation by both existing and new developments.

5. Creating safe and convenient pedestrian access to, from and within the Downtown:
   - minimize the conflict between pedestrian and vehicular traffic at intersections as well as midblock.
   - provide adequate sidewalk space on heavily traveled pedestrian corridors.
   - provide midblock pedestrian pathways where feasible to shorten pedestrian walking distances.
   - design a pedestrian network which responds to the access needs of the physically disabled.

6. Providing for safe and convenient bicycle use as a means of transportation:
   - establish a safe and direct bicycle circulation system into the downtown from residential areas.
   - locate secure bicycle parking facilities near transit centers and major public and private buildings.

- require the provision of secure bicycle parking facilities by new developments, both public and private.

4.2.2 Evaluation

The Berkeley Downtown Plan's focus on transportation was indeed very comprehensive. It addressed the problems at different angles with various approaches to most elements in a good transportation system. Recommendations 1 and 4 were concerned with the use of public transit and reducing trip rates made by private automobiles. While transit service was improved to encourage ridership, single occupant vehicle trips were made more difficult and undesirable in the Downtown area. The indicator of efficiency in public transportation system can thus be used here to evaluate these recommendations because Berkeley has a high density central business districts and a well-developed transit system.

Furthermore, recommendation 2 of the Berkeley Downtown Plan addressed the need for good networking for the roadways to, from and within the Downtown area. As discussed earlier in the paper, I strongly believe that good transportation circulation and networking will have significant impacts and are essential to an efficient and sustainable transportation system. Good networking can not only help to reduce congestion, but also help to contribute to a successful transit system and to further reduce travel time.

Recommendation 3 of the Plan served as a complement to recommendations 1 and 4. Its restraints on the use of existing public and private parking facilities for long term parking especially for vehicles also discouraged commuting by private automobiles and promoted ridesharing or carpooling in conjunction with park-and-ride. Therefore, the sustainability indicator of carpooling can be used to measure this recommendation. On the other hand, recommendations 5 and 6 were to address pedestrians and bicycle use. Similar to Portland's Central City Plan, they were aimed at creating a safe and convenient environment including accessibility to, from and within the Downtown area. Pedestrianways and bikeways were used to complement the roadway infrastructure plan as alternatives of travel to work and school by providing an increased number and improved quality of bicycle facilities in Downtown. The impacts of these recommendations could be quite substantial if implemented successfully. Strategies like this can help improve the air quality and thus a more livable place in terms of the natural environment and the health of people. The resulting impacts could also greatly contribute to the reduced use of energy and consumption for private automobiles leading to a more sustainable environment.

4.2.3 Policy Implications

Similar to the Central City Plan of Portland, the Berkeley Downtown Plan was drafted before the legislations of ISTEA and CAAA. The Plan's recommendations and policies regarding transportation coincided with the provisions in the Acts, demonstrating Berkeley's early efforts in moving the city towards the goal of sustainable development. As suggested previously in the discussion of Portland, Berkeley's open planning process is

essential when using sustainability indicators for evaluation of their polices and recommendations. Citizens and planning officials alike must realize the need to update and revise the plans and polices as they develop over time, and they must also be willing to incorporate the use of indicators in the feedback procedure in the planning process. If the indicators show that progress towards sustainable development may be lacking, then changes or improvements in policies or recommendations must be made in order to reflect such goal.

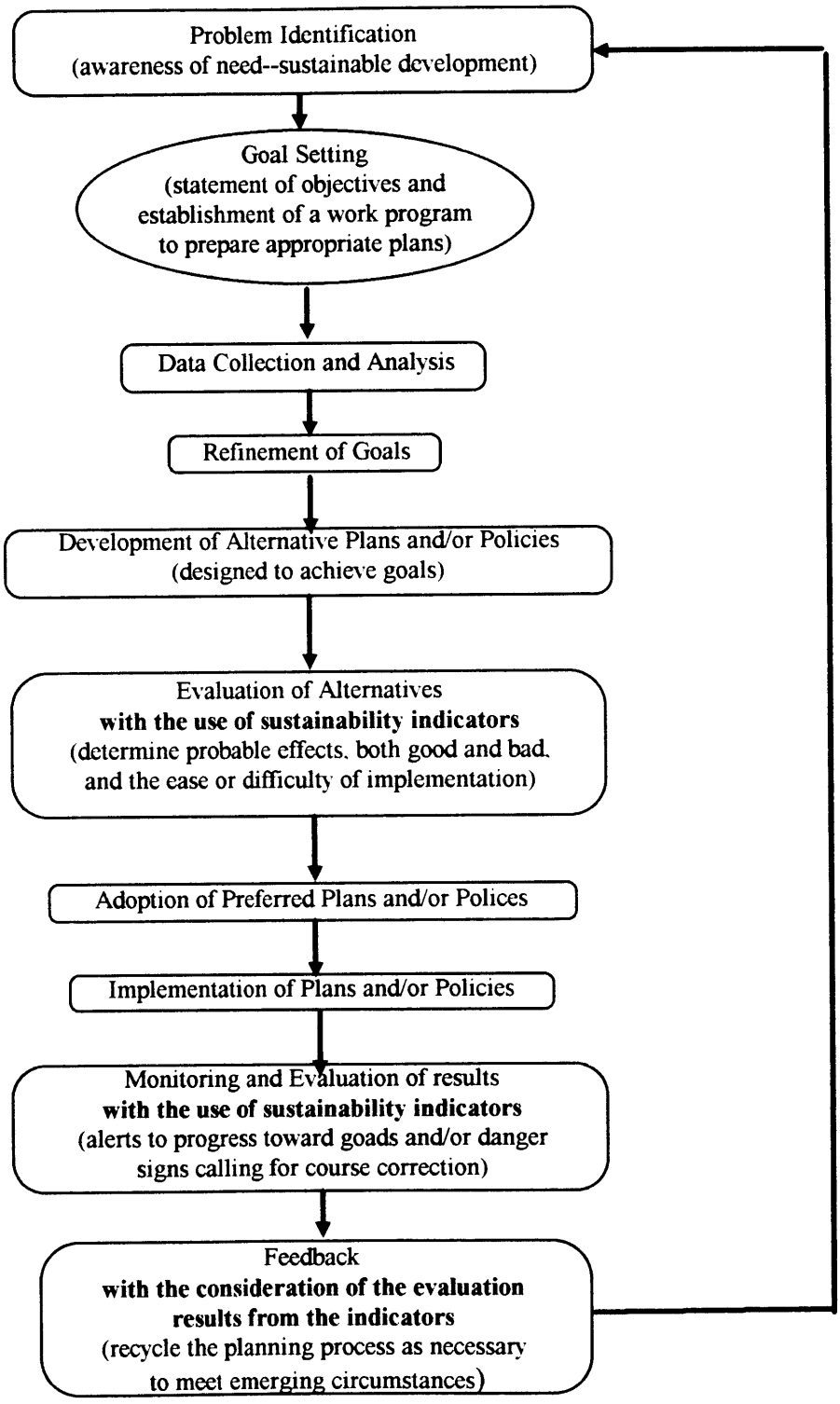
Chapter 5: Conclusion

The legislation of ISTEA and CAAA in the early 1990s recognize the link between the preservation and enhancement of significant natural and cultural resources and transportation decisions [19] Their recommendations on transportation control measures are the foundation of sustainable transportation planning. According to the Surface Transportation Policy Project Resource Guide, one of the most important of these new provisions is contained in the Surface Transportation Program where ten types of activities are defined as "transportation enhancements," eligible for all STP funds. In addition, ten percent of these funds must be set aside for enhancements. This assures a dedicated minimum source of revenue for important but often overlooked activities which fall outside the category of routinely undertaken scenic, historic and environmental activities. These are the first but very significant steps for communities to start the process of sustainable transportation planning.

Indicators for measuring the level of transportation sustainability are developed by various public or private organizations and agencies in the hopes of helping communities to design effective and appropriate tools and strategies. They are designed to help communities measure their progress towards the goal of sustainable development. The purpose is twofold: 1. the indicators can serve as a measure, or mechanism for updating plans in communities which already have implemented strategies; 2. indicators can also

[19] "Beyond Business as Usual: Transportation Plans and Programs", *Surface Transportation Policy Project Resource Guide*. July, 1992.

serve as benchmarks to help communities identify what would be the elements to be included in a sustainable transportation plan. This paper has referenced the indicators used by three sources, the Interagency Working Group on Sustainable Development (SDI Group which is part of the President's Council on Sustainable Development), Sustainable Seattle, a non-profit organization which aims at promoting sustainable development first in the Seattle area then all over the country, and Hart Environmental Data, established by Maureen Hart, an environmental analyst, as the basis both for discussion and also for the indicators I have proposed. The provisions in the legislation of ISTEA and CAAA provide the background and guiding principles for the development of the indicators. The paper then demonstrated how the indicators could be applied for evaluation through the study of the Central City Plan of Portland, Oregon and the Berkeley Downtown Plan of Berkeley, California. From the study it helped us recognize their dedication for implementing strategies leading towards the goals of sustainable development. Sustainability indicators not only can help to measure the progress towards a sustainable future, but also to promote innovations of planning strategies in the realm of policy-making. Specifically, the flow chart in the following page summarizes the roles of indicators and how they can be incorporated in the planning process:


Problem Identification
(awareness of need--sustainable development)
Goal Setting
(statement of objectives and
establishment of a work program
to prepare appropriate plans)
Data Collection and Analysis
Refinement of Goals
Development of Alternative Plans and/or Policies
(designed to achieve goals)
Evaluation of Alternatives
with the use of sustainability indicators
(determine probable effects, both good and bad,
and the ease or difficulty of implementation)
Adoption of Preferred Plans and/or Polices
Implementation of Plans and/or Policies
Monitoring and Evaluation of results
with the use of sustainability indicators
(alerts to progress toward goads and/or danger
signs calling for course correction)
Feedback
with the consideration of the evaluation
results from the indicators
(recycle the planning process as necessary
to meet emerging circumstances)

It should be noted that this planning process sometimes involves ideas that may not be "popular" to or welcomed by some of the constituencies. That is why I believe that another important aspect of successfully implementing sustainable development is for the public officials to be willing to take a stand and risks in carrying out the identified goals for the community as a whole. Sustainable development is not only about any particular recommendations or policies that we can formulate to accomplish the goal, but also involves a change in our traditional belief that some parties may find it uneasy to accept. The goal of sustainable development will not be accomplished in a short period of time. It requires long term dedication and revolution which we must accept.

Figure 1

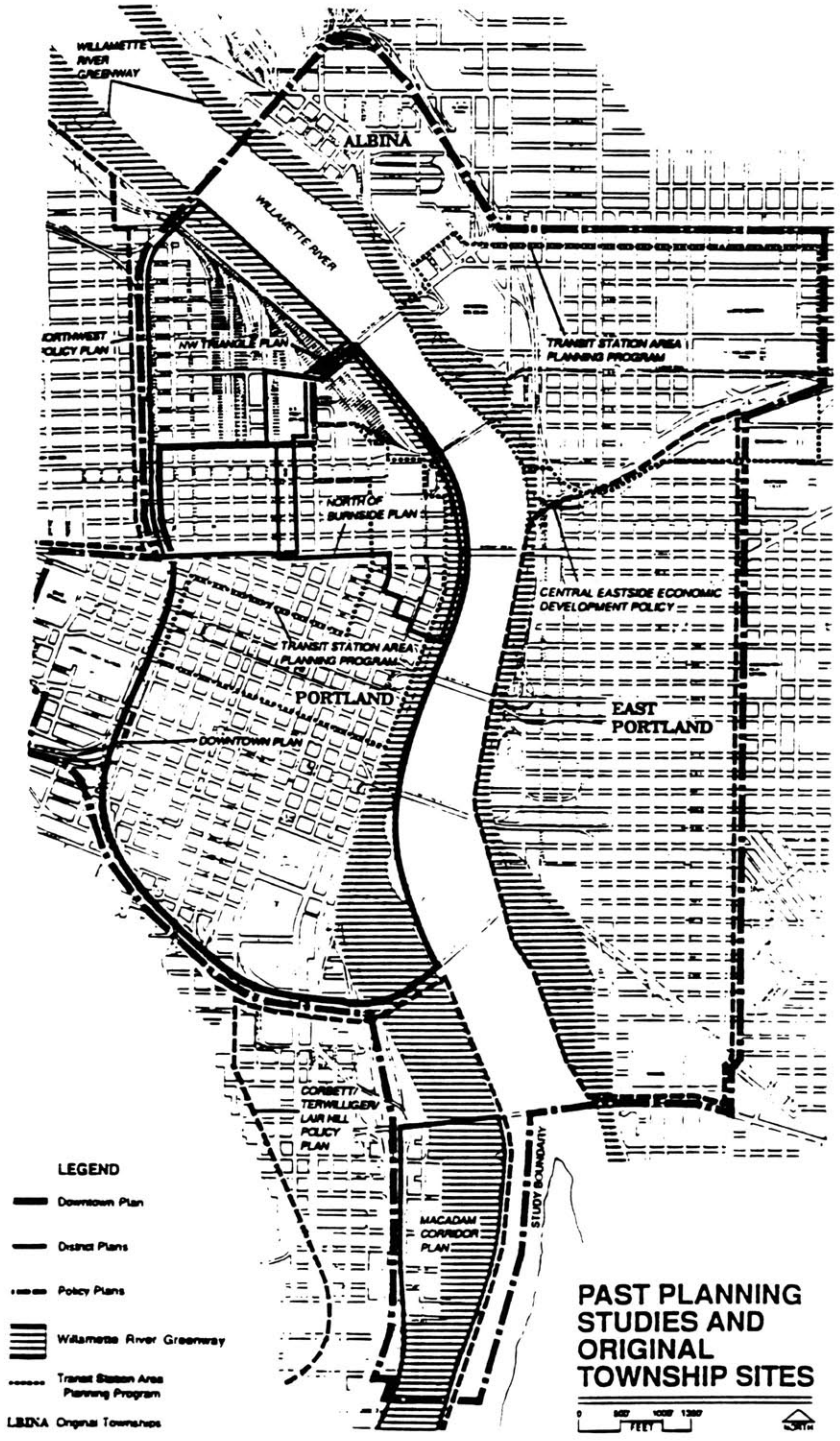
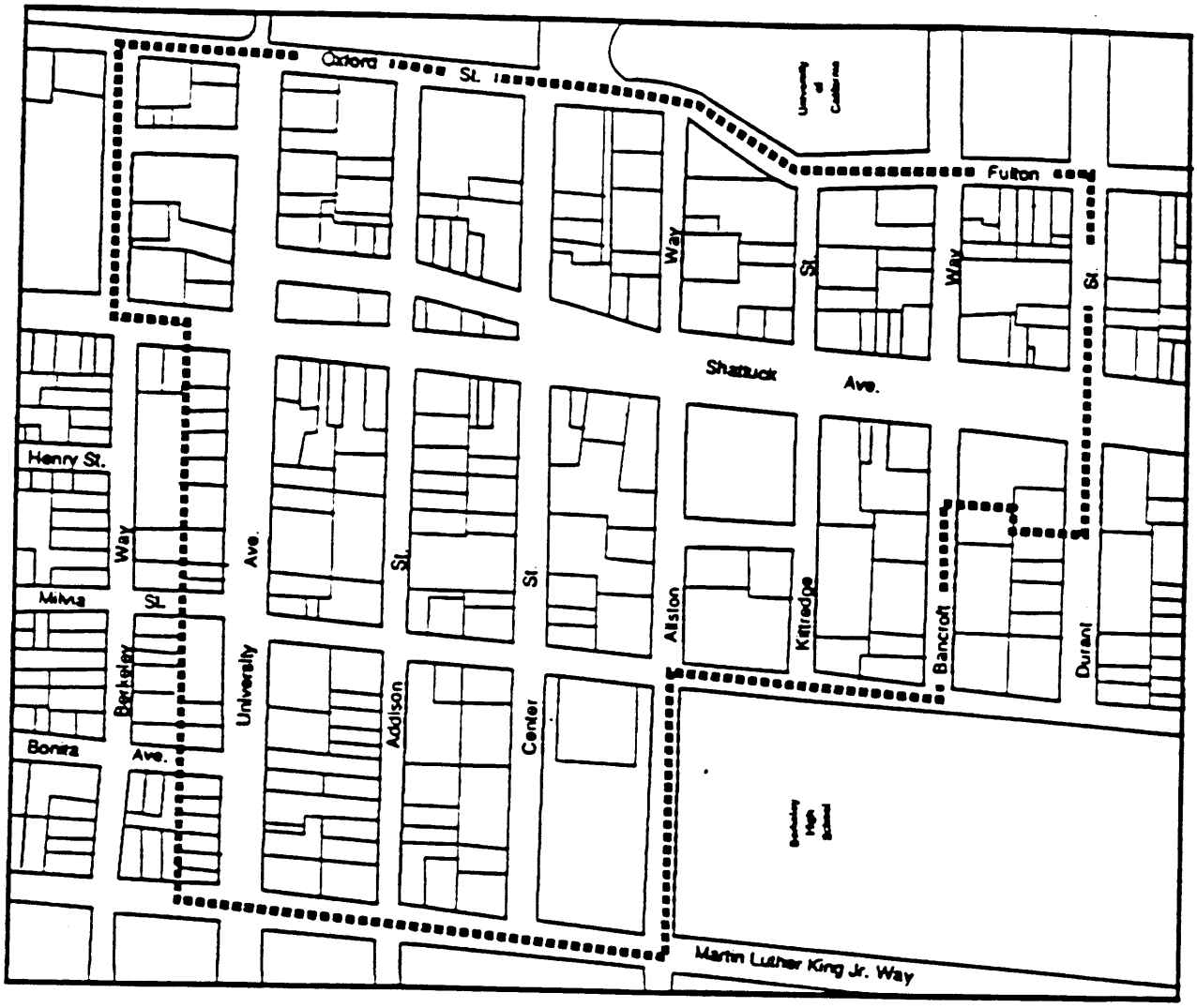

WILLAMETTE RIVER GREENWAY
ALBINA
WILLAMETTE RIVER
NW TRIANGLE PLAN
TRANSIT STATION AREA PLANNING PROGRAM
NORTH OF BURNSIDE PLAN
CENTRAL EASTSIDE ECONOMIC DEVELOPMENT POLICY
TRANSIT STATION AREA PLANNING PROGRAM
PORTLAND
EAST PORTLAND
DOWNTOWN PLAN
CORBETT/ TERWILLIGER/ LAIR HILL POLICY PLAN
MACADAM CORRIDOR PLAN
STUDY BOUNDARY
LEGEND
Downtown Plan
District Plans
Policy Plans
Willamette River Greenway
Transit Station Area Planning Program
ALBINA Original Townships
PAST PLANNING STUDIES AND ORIGINAL TOWNSHIP SITES
0
500'
1000'
1500'
FEET
NORTH

Figure 2



Berkeley Downtown Plan
Study Area

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